

Snapshot imaging polarimeter for satellite aerosol remote sensing

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We discuss the development of a multispectral snapshot imager–polarimeter (MSIP) as one of the instruments intended for the Aerosol-UA space project with the main objective to study the global distribution and the physical properties of aerosol particles and clouds in the Earth’s atmosphere by measuring the polarization state and spectral characteristics of the scattered solar radiation [1]. The main requisite characteristics of the MSIP to meet the experiment purposes are discussed. The optical layout of the polarimeter’s channels is designed. It allows the determination of the linear polarization of the scattered radiation and performing photometric measurements. The polarimeter consists of three optical channels with a $60^\circ \times 60^\circ$ FOV across and along the satellite path at the Earth surface. The instrument measures Stokes parameters I , Q , and U at central wavelengths 410, 555, and 865 nm and with a spectral FWHM of 20 nm. The image-separation system of the MSIP provides the separation of the initial input image into four parallel equal images that are polarized by four sheet polarizers with azimuths 0° , 90° , 45° , and 135° . The MSIP spatial resolution is 6 km in the projection on the Earth surface, which corresponds to the instantaneous field of view of the ScanPol polarimeter. The number of scattering angles for measuring the single observation area is at least 15. The results of testing an experimental version of one of the MSIP optical channels are presented. A numerical polarimetric model for the multi-spectral imager–polarimeter MSIP is developed. The model allows determining the corrections for output signals of the MSIP to improve the quality of polarization measurements and provide orbital intercalibration of the ScanPol and MSIP polarimeters.

References

- [1] Milinevsky G., Yatskiv Ya., Degtyaryov O., *et. al.*, 2016: New satellite project Aerosol-UA: remote sensing of aerosols in the terrestrial atmosphere. *Acta Astronaut.* **123**, 292–300.

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